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TWIN LIGHT SOURCE
STEREOSCOPE LIGHT TABLE

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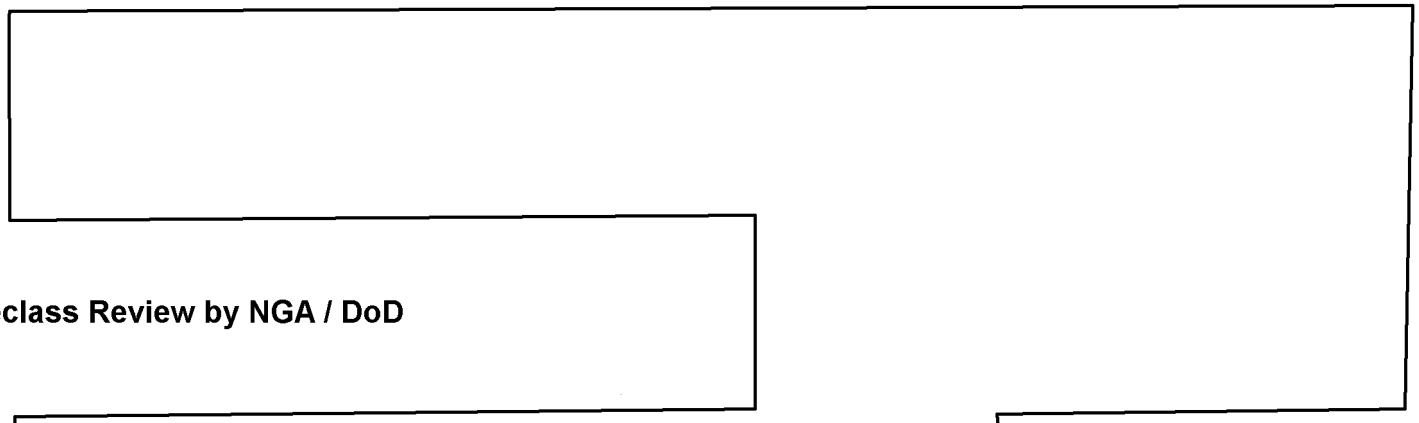

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SECTION 1

INTRODUCTION

1.1 GENERAL

This proposal for the Twin Light Stereoscope Light Table has been prepared by [redacted] in response to the Design Objectives document, dated 10 September 1964.

[redacted] is particularly well qualified in the engineering technologies which are essential for successful design, development and fabrication of the required light table. Of particular value in the proposed program is [redacted] extensive experience in developing equipment for image interpretation systems using direct viewers. Based upon this background, [redacted] can offer assurance of high-quality picture illumination, together with an already developed, precise and reliable dimming control. In all phases of equipment design, the application of sound human engineerinc concepts and thorough reliability planning is well established at [redacted]

1.2 BRIEF DESCRIPTION

The Twin Light Stereoscope Light Table, as shown in Figure 2-1, is a table top unit which presents [redacted] approach to developing a viewer which will meet all the requirements of the Design Objectives.

The special features of this viewer are:

1. Optimum usage of human factors techniques in the design of the equipment.

2. An illumination system incorporating cold cathode grids which will provide the maximum screen brightness and evenness of illumination.

3. A viewing light dimmer which provides brightness control over the entire illumination range without any flickering.

4. A light table tilting mechanism which can not be jarred or slip and thereby cause accidental damage to any glass or optical components.

5. A microscope mount configuration and design which permits easy and convenient alignment of the stereoscope's optical axis to the required 10 minutes of arc.

The light table is 18" deep x 16" wide x 3" high in level position. The detachable stereoscope mount extends 9" above the top surface. The on-off controls and dimming controls are grouped on the top of the rear fixed surface at a convenient angle for operation.

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SECTION 2

FILM VIEWER DESCRIPTION

2.1 OVERALL CONFIGURATION

The Twin Light Source Stereoscope Light Table, as shown in Figure 2-1, is a table top unit which provides the divided viewing surface directly in front of the operator. The viewing controls are conveniently located on the top surface, so that all controls are within easy reach of the operator with no obstruction of the viewing surface or interruption of the viewing operation, when actuating the controls. The viewing surface is split about its front to rear center-line so that each 5" x 6" viewing area becomes independent light sources when the partition is removed. This permits stereo viewing with differing densities or with differing scales. The viewing surfaces, stereoscope mount and controls are all mounted on a front pivoted frame which permits inclination of this light table proper, by the operator, of from 0° to 45° (0° being parallel to the floor). As shown in Figure 2-1, the top of the viewing surface is located less than 3" above the table top. The tilting mechanism located in the rear is manually operated by the operator to raise the rear of the light table proper so that the requested inclination of up to 45° is available (30° tilt is shown in Figure 2-1). However, it should be noted that the B. & L. Zoom 70 and Wild Model M-5 Stereoscopes have their eyepieces set for convenient operator viewing when the imagery is held flat. Note that the controls are convenient for the operator throughout this range and that comfortable viewing is always afforded the operator when seated on a normal desk type chair. The light table does not incorporate reel brackets but provision is made for future mounting of the Richards dual reel brackets (T-2-5) without interfering with any of the controls or viewing functions.

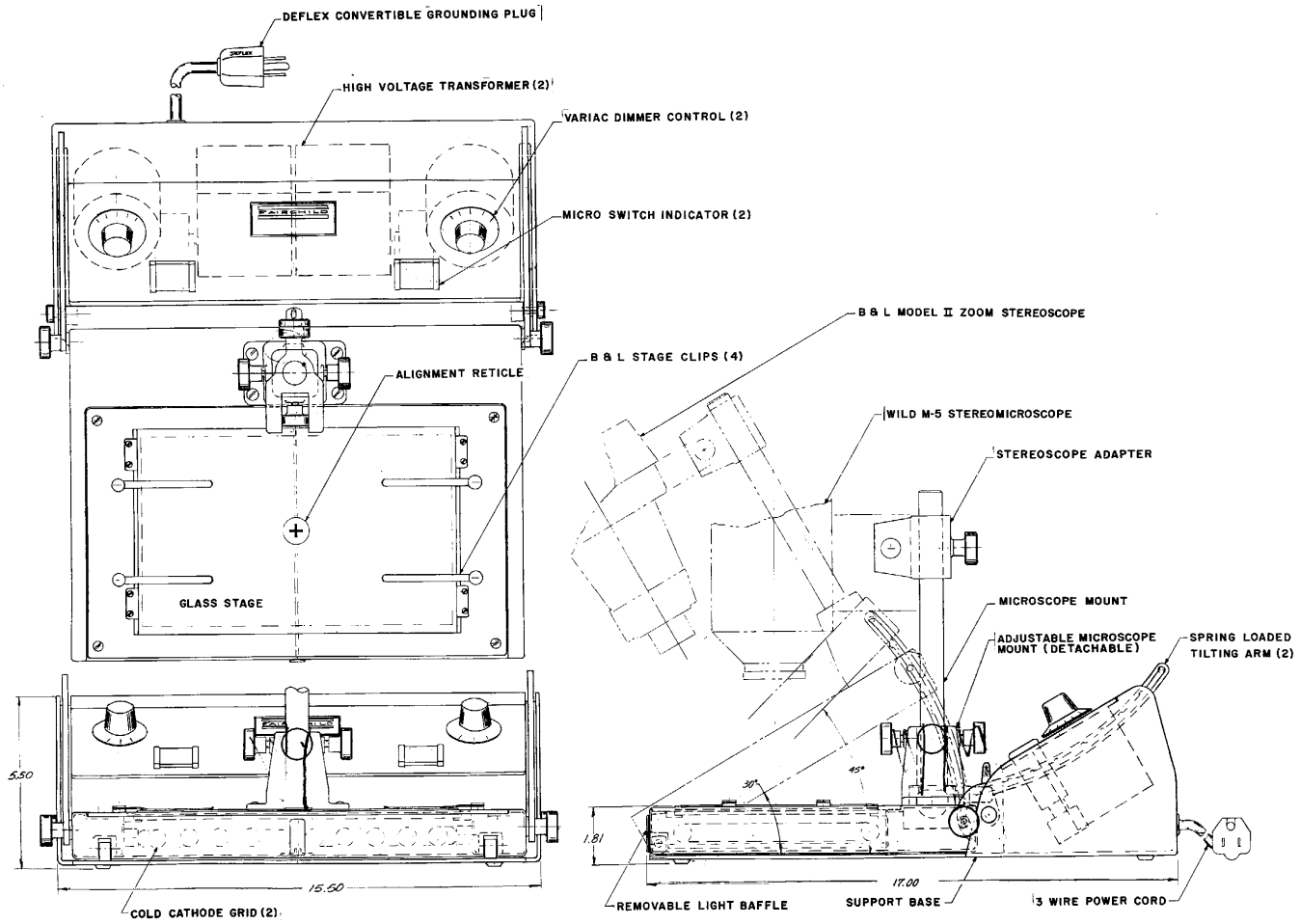

FIGURE 1-1 OVERALL CONFIGURATION

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2.2 ILLUMINATION SYSTEM

2.2.1 Light Sources

STATINTL The light sources proposed by [redacted] will be two 5" wide x 6" deep viewing surfaces directly adjacent to each other for ideal usage as a larger single viewing surface. The two light sources will be high intensity, cold cathode grids. These grids are interchangeable, are not potted or encapsulated and are easily replaced by relatively unskilled personnel using a minimum of the common hand tools. Although the cost of these high intensity, cold cathode grids is considerably greater than that of the standard fluorescent tubes, the advantages obtained result in far greater overall value. These advantages are:

- Service life of 10,000 hours
- No deterioration from frequent on-off cycling
- Minimum height can be realized for table top utilization
- Simpler wiring and circuitry, therefore much greater reliability and down time
- Assurance that illumination is always even and uniform since perimeter grid can be made closer
- With individual tubes there is no guarantee that they will age uniformly, they deteriorate more rapidly with on-off operation and when a tube is replaced, it will be much brighter than the others

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STATINTL is proposing a maximum intensity for each light source, of 2000 ft.-lamberts rather than the specified level of not less than 1500 ft.-lamberts measured at the working surface. The reason for proposing this greater light level is to ensure that the ultimate purpose of this light table is achieved. When viewing photography under magnification the need for illumination increases significantly as the magnification is increased. This is of particular importance if small scale, high resolution photography is being viewed.

The light sources will be sufficiently diffused such that the variation in intensity will not exceed ± 5% as the working surface is scanned along a line which is perpendicular to the light grids. The temperature of the light table will not rise more than 15°F after extended use (6 - 8 hours). The air vents will be baffled to prevent light from shining into the operator's eyes or the eyes of anyone in proximity.

The total viewing area will be approximately 10" wide x 6" deep. The diffuser will be a single piece of opal plastic and the stage will be a single piece of glass. As shown in Figure 2-1, the light baffle, which separates the two grids and prevents light from spilling between the two grid areas, is easily removable. The upper, or working, surface of the glass stage protrudes above the surrounding area by at least 1/16". The metal surface immediately surrounding the viewing stage has four holes, two on each side, for the insertion of the B. & L. Zoom 70 spring stage clips. } NEED MORE

2.2.2 Viewing Light Controls

Another advantage available with the proposed cold cathode grid viewing light sources is the highly reliable dimming control which can vary the brightness over the entire range without any flickering, as usually occurs with standard fluorescent lamps, particularly at the reduced

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light levels. The dimmer control which [redacted] has used successfully in many other applications, see Section 4, utilizes a Variac auto-transformer which varies the input voltage (110 VAC) to the high voltage power supply used with these viewing lights. As shown in Figure 2-1, two separate dimming or brightness controls as well as two separate on-off controls are provided on the top surface since the imagery to be stereoviewed might be of different densities and the stereo fusing is easier done when the imagery is presented on a comparable image brightness basis.

Each dimming control will vary the intensity of its light source from 100 to 2,000 ft.-lamberts, twice the specified range, without noticeable flicker at any level of intensity. The two independent controls are conveniently located at the rear of the light table within comfortable reach of the operator from the front, yet not interfering with any of the viewing functions. The separate on-off switches will incorporate built in lamps which indicate when the light source has been turned on and the switch button will be suitably engraved.

The light table will operate on a nominal 115 volt, 50-60 cps supply, and will use approximately 200 watts of power. The light table will be equipped with a 3-wire power cord, not less than six feet long, terminated at one end with a "Deflex" Safety Power Connector (made by the APM-Hexseal Corporation, 41 Honeck Street, Englewood, New Jersey), or its equivalent. The other end shall be terminated within the light table and shall be securely mounted to the frame of the light table. The third (ground) conductor in the power cord shall be grounded to the metal frame of the light table.

2.3 TILTING MECHANISM

The light table with the stereoscope attached, is capable of being tilted about an axis along the front of the light table as shown in Figure 2-1. This tilting permits the operator to place the viewing stage in the

[redacted]

horizontal position or up to a maximum angle of 45° to the horizontal. However [redacted] must point out the fact that the inclination of the stereoscope's eyepieces will correspondingly be shifted from what is normally the convenient viewing angle.

In providing the 45° of tilt [redacted] considers the usage of a ratchet and pawl, device as shown in the Design Objectives to be a dangerous design. Accidental jarring or shock might cause damage to the glass, light grids or optical components. A more reliable and functional design is to use the captive slotted linkage shown in Figure 2-1. Not only is this mechanism positive (non-slipping) but it also provides continuous adjustment throughout the 45° range.

2.4 MICROSCOPE MOUNT

The microscope mount shown in Figure 2-1, can be used with either the B&L Model II Zoom 70 Stereoscope, the Wild Model M-5 Stereomicroscope, or by use of the clamp type adapter -- any similar stereoscope or microscope of approximately the same size and weight. Properly designed clamping members permit changing merely by the use of thumb screws. The stereoscope supports and clamps are sufficiently rigid, and sufficient mechanical advantage is provided for tightening torques so that no play will occur after any changes in mounting or alignment. The gross positioning is made with the primary "Clamp-On" mount for approximate focusing with a particular, auxiliary lens system. The rack and pinion adjustment (normally part of the supporting arm of the stereoscope or microscope) is then used to bring the image into sharp focus.

Alignment of the stereoscope's optical axis is maintained to within 10 minutes of arc of a right angle to the viewing stage. The requirement for "maintaining the alignment of the stereoscope's optical axis

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to within 10 minutes of arc of a right angle to the viewing stage" is more critical than it appears to be. The provisions to be made for providing this degree of alignment, regardless of the type of stereoscope or microscope in use, must utilize the optical axis itself. If precision levels were considered as the means for determining alignment, it would be necessary to have a mounting surface on the instrument which maintains some precise geometry to the optical axis. The standard B&L Zoom 70 Stereoscope and the standard Wild M-5 Stereomicroscope do not have this feature. Therefore,

STATINTL proposes that an "Alignment Reticle" be used in conjunction with continuously variable adjustments in X and Y for providing this degree of alignment. The alignment reticle is a standard glass reticle consisting of a series of precise concentric circles. By viewing this reticle through the specific stereoscope to be used at its highest magnification a determination of the preciseness of the alignment of the optical axis to the stage can be made. At high magnification, the depth of field (focus) becomes extremely short. By observing the sharpness of the extremes of the reticle with respect to the sharpness of the center of the reticle, the degree of alignment is determined. The instrument's alignment will have been attained when the entire reticle appears in sharp focus. A reticle is proposed because it has the high contrast and resolution as well as sharp features which facilitate focusing capability and subsequently, alignment capability.

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SECTION 3

OPTIONAL FEATURES

The Twin Light Source Stereoscope Light Table was designed in accordance with the Design Objectives, dated 10 September 1964. However, wherever practicable, the design and layout of components was made so that present proposed light table can be easily modified to increase its operational capability. The salient features which can be added to the light table with a minimum of modification are as follows:

3.1 MOTORIZED FILM DRIVE

STATINTL In addition to providing the capability for mounting Richards Corp. dual reel brackets, Model T-2-5 at a later date [redacted] can easily implement the incorporation of motorized film winding and rewinding. This added capability for efficiently utilizing roll film merely involves the addition of a compact reversible variable speed drive system which is easily incorporated within the present configuration. Slew speeds of up to 300 f.p.m. are easily attainable STATINTL using standard [redacted] developed film drives.

3.2 FILM FOOTAGE COUNTING

STATINTL If roll film is used it becomes important for the P.I. to accurately locate the specific frames he is to stereoview. [redacted] can easily implement in the future 4 digit film footage counters which will also provide high accuracy and readout to 0.5 ft. This capability of accurate film footage or frame counting and recovery has proven to be very desirable in detailed photo interpretation work. Essentially,

the film footage count would be established by a precisely ground metering roller of 1.9099" so that 1 revolution meters 6" (0.50 ft.) of film. A cam is coupled to this metering roller which activates a switch so that one revolution or count, corresponds to 0.50 ft. Since the counting is digital, the maximum error that would be attributable to the mechanical portion of film footage counting is only 1 count or 0.5 ft. With properly designed film transport systems having dynamic braking and excellent reversibility characteristics, the slippage of the capstan or pressure roller drive can be considered to be negligible. Therefore, the most significant factor affecting the accuracy of film footage counting is the preciseness of the ground metering roller. Since rollers can easily be ground to within tolerances of ± 0.001", the maximum error could be 0.003" of film per revolution (6 inches of film) or 0.006" of film per foot. Therefore, an accuracy of essentially 1/2" of film per 100 ft. could be maintained with zero film slippage.

3.3 FILM FLATTENING

For most efficient stereoviewing, particularly under reasonable magnifications, the two images must be fixed in the same viewing plane. Various means exist for obtaining film flatness, the simplest of which is to sandwich the film between the glass stage and glass plates. However, care must be exercised while stereoviewing so as not to jar the final positioning of the film which resulted in the fused imagery. By building these glass flattening plates into the light table structure, the likelihood of accidentally shifting the film after the imagery has been positioned and fused is eliminated. The glass platens would be hinged so that they can easily be retracted when not required.

3.4 SLACK LOOP PROVISION

When photographs are inseparably contained on their supporting media (film or paper) in fixed relationship to each other as negatives (or contact prints) on uncut rolls of film (or paper), no possibility exists to place physically the corresponding image into the correct position as required for stereo perception.

By utilizing the space between the two light sources to form a slack loop capable of accumulating the required amount of film, two images which are separated by more than the Zoom 70 Stereoscope's rhomboidal separation can be stereoviewed while in roll form.

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SECTION 4

RELEVANT EXPERIENCE

4.1 INTRODUCTION

STATINTL extensive experience in the development of Image Interpretation Film Viewers is a valuable asset in the development of this direct viewing Light Table. In addition to the development of compact cameras, stabilized mounts and film processing units for airborne use STATINTL is continually engaged in the development of precision equipment for the ground based operations of film viewing and interpretation. The exacting demands of this latter technology have imposed on STATINTL engineers a stringent discipline which leads to a critical appraisal of design concepts and the deft execution of the actual design and construction. Of particular significance in developing image interpretation equipment is STATINTL recent and current experience in the development of the Image Interpretation Cell (IIC), wherein close field association with the various Air Force tactical reconnaissance commands has acquainted us with the "working level" P.I. requirements. The IIC was designed and fabricated by STATINTL under Air Force Contract AF30(602)-2882, for the prototype, and AF30(602)-3256 for the production systems. The IIC is a completely self-contained, deployable, image interpretation system for the generation of forward echelon, accurate intelligence data in the form of Flash and Immediate Photo Interpretation Reports. The IIC was subjected to a series of mechanical and environmental tests which verified the soundness of the product design and its capability for sustained operation in the military environment. Examples of STATINTL Image Interpretation Film Viewer developments which are closely related to this proposed program are discussed below.

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4.2 MULTI-SENSOR VIEWER

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The Multi-Sensor Viewer, [redacted] was developed by [redacted] for integrated interpretation and analysis of multi-sensor data.

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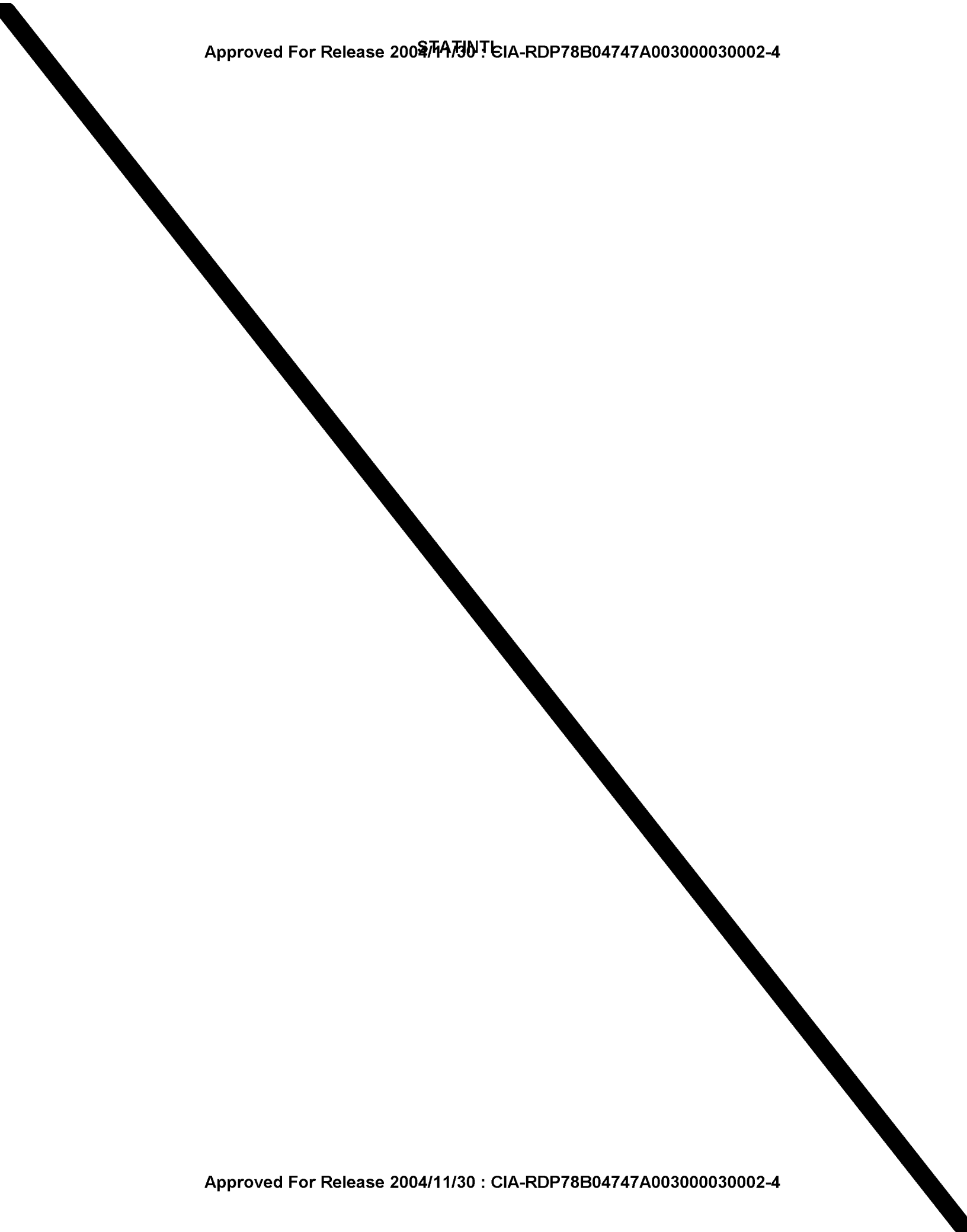
The MSV, see Figure 4-1, provides simultaneous direct viewing of 70mm to 9-1/2 inch film at four stations. Hard copy print reproduction under normal room light conditions and full mensuration capability, with digital readout, is provided at all four film stations. Stereo viewing with zoom magnification is provided at the two horizontal stations with a slack loop drive on the first station (panoramic channel) for points up to 72" apart. In addition, the TTR projection viewer located on top, enables viewing of 70 X 100 mm film chips at 4X magnification for comparison viewing. The operator may display at random any one of 100 chips contained in a removable magazine. Ten extra chip magazines, each containing 100 chip holders are stored within the MSV.

SPECIFICATIONS

Dimensions (inches):	74 w x 73 h x 40 d (nominal)
Weight (pounds):	1150 (approximate)
Power Requirements:	120/208 VAC, 400 cps, 3 phase, 2200 watts. 120 VAC, 60 cps, single phase, 300 watts.



Film Capacity:	70mm rolls up to 1000 ft. (all stations) 5 inch rolls up to 1000 ft. (all stations) 9 inch rolls up to 1000 ft. (frame station only) 70 x 100 mm chips - 100 per magazine (TTR viewer)
Viewing Surfaces:	9-1/2 x 27 inches (frame station) 5-1/2 x 27 inches (SLR and IR stations) 5-1/2 x 12 inches (two at panoramic station)
Viewing Surface Illumination:	Cold Cathode - Adjustable Brightness 40-1000 ft.-lamberts
Vacuum System:	Provided for each viewing surface
Printing:	3 stations with 5 x 9-1/2 inches 1 station with 9-1/2 x 9-1/2 inches
Print Exposure:	1 to 5 seconds
Processing Time:	15 seconds
Film Drive Velocity:	Each station independently adjustable up to 150 FPM, option of individual or ganged drive with 2% accuracy. Reversible individual and master speed control

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Film Footage Counting:	Provided for each station, resettable counters readout to two-tenths of a foot. Accurate to 1% with reversing control to permit adding when metering from either direction.
Mensuration:	X and Y Digital readout to 0.001 inch. Accurate to 0.004"/inch. Crosshair positioned by joystick.
Stereo Viewer:	Bausch and Lomb AR26A modified, with zoom magnification range of 2-1/2 to 36 power and image rotation of ±180°.

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4.3 [redacted] 5 INCH VIEWER/PRINTER (PORTABLE)

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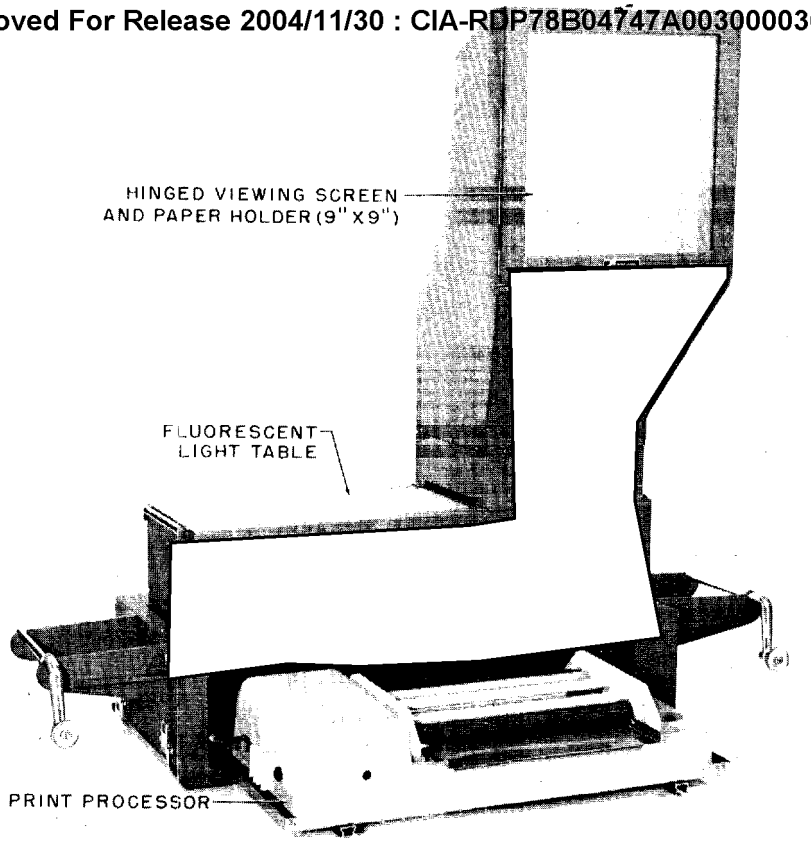
The [redacted] Viewer/Printer, see Figure 4-2, is a portable instrument consisting of a light table and base, a print processor mounted within the base, a viewing hood, spool holders and carrying case.

Set up ready for use, less film spools, the F-512 is approximately 24" long, 12" high, and 12" wide, with a 21" high projector hood mounted on the right hand side of the instrument.

The complete encased instrument, ready for carrying, measures approximately 25" x 24" x 12". Weight is approximately 65 lbs.



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VIEWER/PRINTER

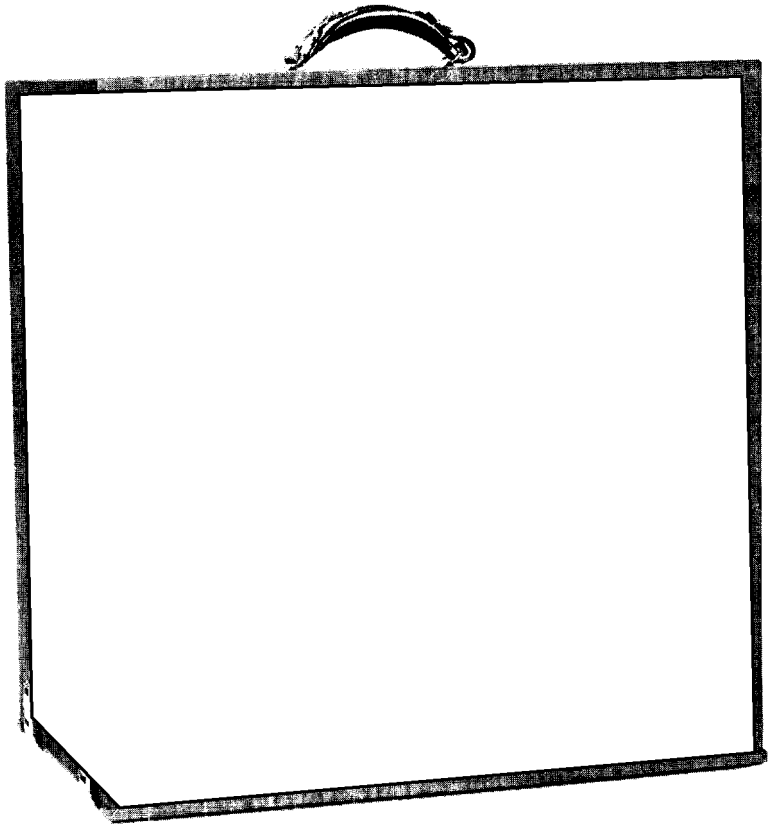

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FIGURE 4-2 WITH COVER ATTACHED READY FOR TRANSPORTATION

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Illumination for the light table consists of three fluorescent tubes with a translucent diffusion panel as a viewing surface. A 300 watt projection type filament lamp, used with double condensing lenses and an f/4.5 projection lens, provides illumination for imaging the negative on the 9" x 9" viewing screen.

The print processor is motor driven and has a removable roller assembly. Processing solutions (developer and stabilizer) are in 32 oz. flexible plastic bottles (for durability and light weight).

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The purpose of the [redacted] Viewer/Printer is to provide a convenient means for--

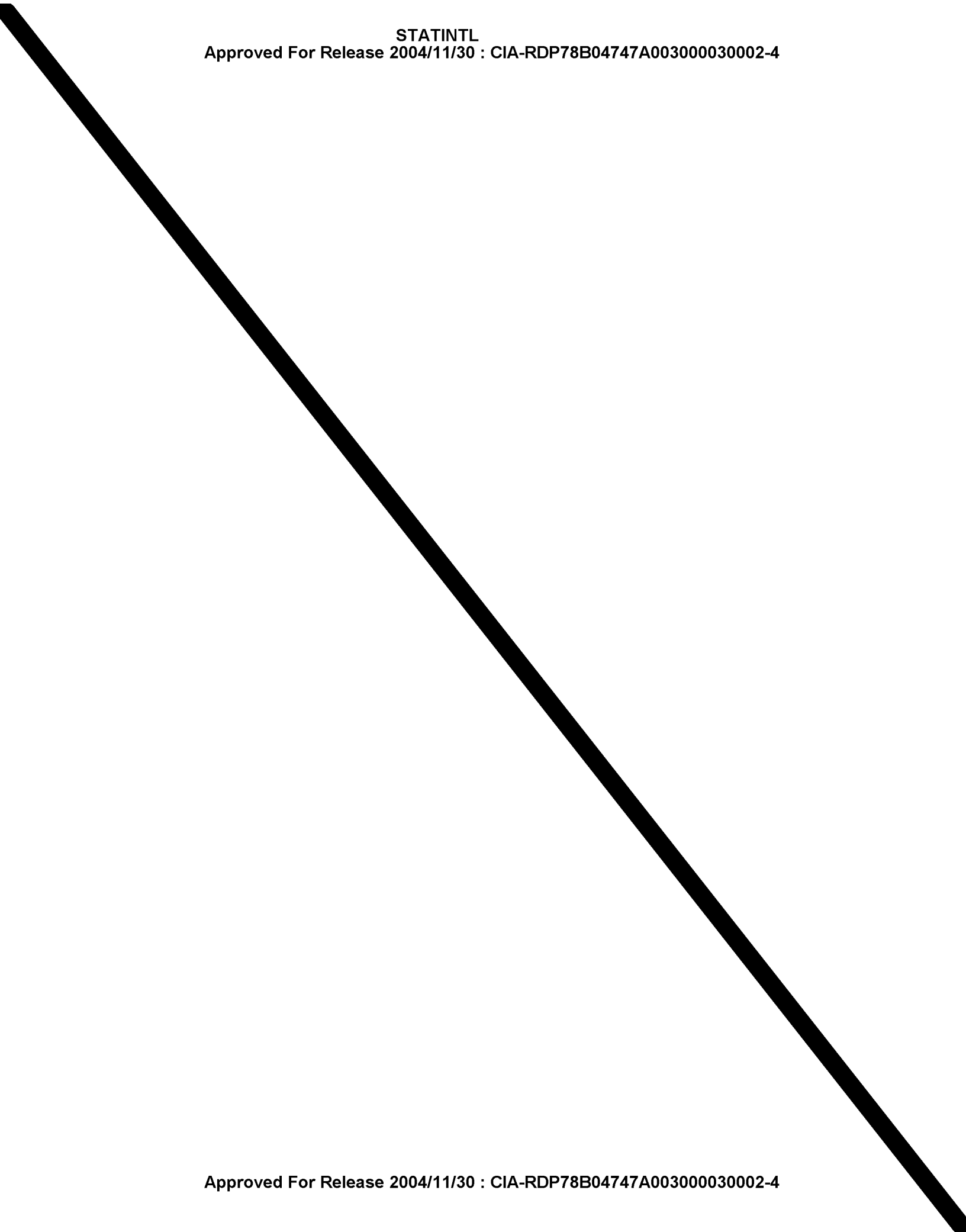
(a) viewing 5 inch wide aerial negatives in roll form on an illuminated light table.

(b) viewing a 2X enlarged image of each 4-1/2" by 4-1/2" negative, or similar section of a panoramic negative, on a 9" x 9" rear projection screen.

(c) obtaining 9" x 9" positive enlargements of each negative (or stereo pairs) on photographic paper under subdued room light (no darkroom necessary).

4.4 IIC LIGHT TABLE

The Image Interpretation Cell Light Table served as a detailed interpretation station to supplement the activities of the MSV and to provide a working area for detailed interpretation and analysis. As shown in Figure 4-3, it provides direct or stereoscopic viewing of positive or negative film from 70mm to 9-1/2" in width and up to 1000 ft. capacity rolls. The film is secured to the light table by a vacuum hold down



system for mensuration or viewing under magnification. A carriage and rails are provided to provide movement in the X and Y direction of the stereoscopes over the 10" x 39" viewing surface.

The Light Source - two argon-mercury grids of serpentine pattern - is embedded in an optically clear, elastomer matrix for protection against mechanical shock and humidity damage. This source will provide diffused "cold" light of a maximum intensity of at least 1200 ft.-lamberts at 70°F. "Cold" light refers to the low heat output of the grid, a 15°F temperature rise over a 4 hour period. Uniform diffusion is accomplished by mounting the plastic diffuser at the correct distance from the grids.

The film under observation can be held securely to the glass top if desired. The top contains front and rear vacuum grooves which are connected to silicone rubber vacuum manifold tubes connecting to the outer edges of the glass top.

When 9-1/2" wide film is being used, the vacuum is applied to both manifolds. For 70mm and 5" wide film, the vacuum is only applied to the front groove, which is covered by the film.

The film reels are held between brackets attached to the table in either the left or right T-rails. Each table is supplied with two sets of Reel Brackets, each set consisting of one crank and one idler bracket. The machine will accommodate single reels of any size from 70mm to 9-1/2" in width up to 1,000 feet capacity. The brackets are equipped with drag brakes, cam operated spindle retractors and full ball bearing suspension in all instances. Segmented nylon rollers at each end of the table provide scratch-free film support. The cranks provide a pivoting detent of the handle so that it can be rotated out of the way when not in use.

SECTION 5

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SECTION 5

PROGRAM SCHEDULE

The program schedule, as shown in Figure 5-1, will include sufficient time for study, investigation and analysis of the product design configuration finalized at the completion of the first month. Complete and accurate layouts will establish the design parameters and interfaces. All major components and subsystems, optical, mechanical and electrical, will have been selected and specified. Human engineering factors will be thoroughly explored and all operating functions will be checked out. The long lead items, controls, structures and viewing lights will be ordered and detailing will commence in full.

Reproducible manufacturing drawings and specifications will be delivered as shown in Figure 5-1, one week after delivery of the Twin Light Source Stereoscope Light Table.

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SECTION 6

QUALITY ASSURANCE AND RELIABILITY

6.1 INTRODUCTION

STATINTL The Quality Assurance and Reliability functions at are integrated within These Departments report to the General Manager. The degree of responsibility exercised by each with regard to the coverage in these areas depends on the nature of the program. In the case of a developmental type of program where the quantities of equipments are very limited, the primary responsibility for both Quality Assurance and Reliability rests with the Engineering Department. As the quantities increase and the requirements and methods become more firmly established, the responsibility shifts to the Quality Control Department. This section describes the proposed procedure which will be used as a guide in the case of this Twin Light Stereoscope Light Table.

STATINTL The Quality Control program at now in effect on existing projects is in compliance with MIL-Q-9858. The procedures employed are under the surveillance of the resident Air Force inspector.

STATINTL The Reliability Program at now in effect on existing projects is in compliance with MIL-R-27542. The reliability organization is shown in Figure 6-1, and its

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